

POOR LEGIBILITY

ONE OR MORE PAGES IN THIS DOCUMENT ARE DIFFICULT TO READ
DUE TO THE QUALITY OF THE ORIGINAL

TM 9-850

U
408.3
.A5
TM 9-850

TM 9-850

WAR DEPARTMENT

TECHNICAL MANUAL

CLEANING, PRESERVING, LUBRICATING,
AND WELDING MATERIALS AND
SIMILAR ITEMS ISSUED BY THE
ORDNANCE DEPARTMENT

April 13, 1942

TECHNICAL MANUAL

CLEANING, PRESERVING, LUBRICATING AND WELDING
MATERIALS AND SIMILAR ITEMS ISSUED BY THE
ORDNANCE DEPARTMENTCHANGES
No. 1 }WAR DEPARTMENT,
WASHINGTON 25, D. C., 23 December 1943.

TM 9-850, 13 April 1942, is changed as follows:

33.1. (Added.) Preventive cleaning of automotive internal combustion engine cooling systems.—Materials and tools available for this purpose, as well as instructions covering cleaning, neutralizing, flushing, examining for leaks, and cooling are given in section X.

[A. G. 300.7 (23 Oct 43).] (C 1, 23 Dec 43.)

SECTION X (Added)

PREVENTIVE CLEANING OF AUTOMOTIVE INTERNAL
COMBUSTION ENGINE COOLING SYSTEMS

131. General.—This section provides instructions for preventive cleaning of automotive internal combustion engine cooling systems, to be performed by second echelon of maintenance.

132. Materials.—The materials required for this purpose are listed and available under the following Federal stock numbers:

	<i>Federal stock number</i>
Compound, cleaning.....	51-C-1563-500
Compound, inhibitor, corrosion.....	51-C-1600

compound, cleaning, consists of the cleaner compound and the neutralizer compound, packed in separate containers within a single package.

133. Preventive service.—It is recommended that the following procedure be performed at least twice a year. The cooling system should be cleaned before the compound, antifreeze (ethylene glycol type) is put into the system, and again after it is removed. Cleaning at the prescribed intervals will reduce clogging and overheating to a minimum, and will largely eliminate the necessity for corrective cleaning by a higher echelon. If the cooling system is very dirty or clogged so that overheating occurs, ordnance personnel should be notified. The entire cooling system should be examined for leaks both before and after cleaning and flushing. *The cleaning solution should never be mixed with antifreeze compound or other antifreeze solutions, or with inhibitors.*

a. *Cleaning.*—(1) Open the petcocks which shut off the coolant from the heaters or other accessories, to allow for complete circula-

tion during the cleaning, flushing, and draining. Run the engine, with the radiator covered if necessary, until the temperature is within operating range. Stop the engine, remove the radiator cap, and drain the system by opening the drain cocks in the radiator and block; check with the cooling system drain caution plate on the instrument panel for position of drains, if the vehicle is equipped with such a plate. If necessary, use a wire to keep open any drain hole which tends to become clogged.

(2) Allow the engine to cool. Disconnect the radiator overflow return tank if the vehicle is so equipped. Close the drain cocks; pour water slowly into the radiator until the system is approximately half full, then run the engine at idling speed. Add the cleaning compound in the proportion of one container of cleaner to every 4 gallons of cooling system capacity. Then complete filling the system with water. *Never mix the water and the cleaning compound before putting them into the system.*

Caution: Do not spill the solution on skin, clothing or painted portions of the vehicle.

(3) Place a clean drain pan in position to collect the overflow, using the overflow to maintain the level in the radiator if necessary.

(4) Replace the radiator cap and run the engine at fast idling speed, covering the radiator if necessary, until the coolant reaches a temperature above 180°, but not over 200° F. Do not drive the vehicle. Constantly check the level in the radiator.

(5) Stop the engine after it has run for 30 minutes at at least 180° but not over 200° F. Then remove the radiator cap and drain the system completely.

b. Neutralizing.—(1) Allow the engine to cool. Close the drain cocks; pour water slowly into the radiator until the system is approximately half full, then run the engine at idling speed. Add the neutralizer compound in the proportion of one container of neutralizer to every 4 gallons of cooling system capacity. Then fill the system with water.

(2) With the radiator covered, let the engine idle for at least 5 minutes at the normal operating temperature. Then stop the engine.

(3) Drain the system completely by removing the radiator cap and opening all the drain cocks.

c. Flushing.—(1) Allow the engine to cool. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full, then run the engine at idling speed and fill the system completely.

(2) Run the engine, keeping the radiator covered if necessary, until the coolant is heated to the normal operating temperature.

(3) Drain the system by removing the radiator cap and opening all the drain cocks. Repeat the flushing operation until the drain water is clear.

(4) Again allow the engine to cool and then clean all sediment from the radiator cap valves and the overflow pipe. Blow insects and dirt from radiator core air passages with compressed air, blowing from the rear. Use water if necessary to soften obstructions.

(5) If the system is equipped with an overflow tank, flush the overflow tank and pipe by filling with water and then draining both completely.

d. Leaks.—After completing the flushing operation, make certain that the engine has been allowed to cool again. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full, then run the engine at idling speed and fill the system completely. Stop the engine when the cooling system is completely full. Examine the entire cooling system for leaks. This is important because the cleaning solution uncovers leaks which already exist but are plugged with rust or corrosion. Leaks that cannot be corrected by the using arm should be reported immediately to ordnance maintenance personnel.

e. Coolant service.—(1) When servicing the vehicle for summer, fill the system nearly full with clean water. Add compound, inhibitor, corrosion, in the proportion of one container of inhibitor to each 4 gallons of cooling system capacity. Then complete filling the system with water.

(2) When servicing for winter, fill the system about one-quarter full of clean water. Add sufficient compound, antifreeze, (ethylene glycol type) for protection against the lowest anticipated temperature. Add water until the system is nearly full, then run the engine until the normal operating temperature is reached. Then add sufficient water to fill the system to the proper level, as indicated in the Technical Manual pertaining to the matériel. See TB 700-20 for antifreeze installation instructions.

[A. G. 300.7 (23 Oct 43).] (C 1, 23 Dec 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

JUN 29 1942

*TM 9-850

TECHNICAL MANUAL
No. 9-850

Property of U.S. WAR DEPARTMENT.
WASHINGTON, April 13, 1942.

CLEANING, PRESERVING, LUBRICATING, AND WELDING MATERIALS AND SIMILAR ITEMS ISSUED BY THE ORDNANCE DEPARTMENT

	Paragraphs
SECTION I. General.....	1-3
II. Cleaners and abrasives.....	4-33
III. Preservatives.....	34-47
IV. Paints and related materials.....	48-68
V. Lubricants.....	69-77
VI. Fluids for recoil mechanisms and hydraulic jacks.....	78-82
VII. Welding and brazing materials.....	83-100
VIII. Carbon dioxide fire extinguishers.....	101-115
IX. Miscellaneous.....	116-130
APPENDIX. List of references.....	Page 102
INDEX.....	103

SECTION I

GENERAL

	Paragraph
Purpose.....	1
Scope.....	2
References.....	3

1. Purpose.—a. The purpose of this manual is to present information to the using arms and services concerning the characteristics, application, and handling of cleaning, preserving, lubricating, welding, brazing, cutting, and other materials issued by the Ordnance Department and listed in SNL's K-1 and K-2. Information and directions given here will supersede those given in TR 1395-A and in the various Ordnance Field Service Circulars published prior to publication of this manual and dealing with materials within its scope.

b. Specific instructions are given in this manual on "cleaning, preserving, and lubricating materials, recoil fluids, special oils, and similar items of issue" as listed in SNL K-1, and no "soldering, brazing, and welding material, gases, and related items" as listed in SNL K-2.

*This pamphlet supersedes TM 9-850, August 21, 1941; TR 1395-A, January 9, 1939; and Advance Information on Care and Preservation of Seacoast Artillery, June 19, 1941.

9 030955

PROPERTY OF U. S.

2. Scope.—*a.* Instructions in this manual concern materials issued by the Ordnance Department for specific purposes, and care should be taken that they are used for the purposes specified and in the manner prescribed.

b. Use of materials other than those authorized for the specific purposes mentioned is strictly forbidden.

c. Not all of the materials listed herein are authorized for issue to troops. Arsenals and depots of the Ordnance Department, and depots at line posts and small ordnance establishments are charged with the preservation of ordnance matériel under storage conditions. Because of the greater magnitude of this work and the problems of economical preservation over long periods of time, it may be found necessary to use the additional materials listed here which are not required for issue to troops.

3. References.—*a.* Allowances of cleaning and preserving materials initially issued to the various organizations of the Army are given in Tables of Allowances; those for the units of the National Guard, in National Guard Regulations and circulars; and those for the units of the Reserve Officer's Training Corps and Organized Reserves, in Army Regulations.

b. Unit prices, specification numbers, and packaging of cleaning, preserving, and lubricating materials, recoil fluids, special oils, and similar items of issue are published in SNL K-1. The unit prices, specification numbers, and packaging of welding, brazing, cutting, and soldering materials, and related items are published in SNL K-2.

c. Instructions for painting and marking of projectiles are covered by standard ordnance drawings (class 75, division 14) and U. S. Army specifications. To identify service markings of ammunition and ammunition containers, reference should be made to appropriate Technical Manuals and ordnance drawings.

d. Instructions for the application of lubricants, recoil oils, and preservatives (rust-preventive compounds or paints and related materials) are given in detail in the Technical Manuals covering the particular materials. However, general information applicable to most units will be furnished in this Technical Manual so far as it is possible to do so.

SECTION II

CLEANERS AND ABRASIVES

	Paragraph
Cleaning of small bore arms.....	4
Metal fouling.....	5
Ammonia, 28 percent.....	6
Ammonium carbonate.....	7

Paragraph

Ammonium persulfate.....	8
Solution, metal-fouling.....	9
Burlap, jute.....	10
Carbon tetrachloride.....	11
Cleaner, rifle bore.....	12
Cloths.....	13
Paper, flint.....	14
Wastes.....	15
Compounds.....	16
Lime, hydrated.....	17
Soda, caustic (lye).....	18
Paper, lens, tissue.....	19
Care of optical glass.....	20
Patches, cut (canton flannel).....	21
Polish, metal, paste.....	22
Soap, castile.....	23
Soap, saddle.....	24
Paraffin (grade 117-120).....	25
Oil, neat's-foot.....	26
Dressing, russet leather.....	27
Care of leather equipment.....	28
Soda ash.....	29
Sponges.....	30
Solution, sponging.....	31
Solvent, dry-cleaning.....	32
Decontamination.....	33

4. Cleaning of small bore arms.—*a.* Formerly it was thought that corrosion in the bores of small arms might be due to the action of powder gases actually squeezed into the pores of the metal. Investigation has shown that this is not the case. The bore of a small arm, under the action of pressure and heat from burning powder gases, is hardened in a manner similar to that which forms the so-called case-hardened surface on steel. Under the further action of heat, pressure, and abrasion, the hardened surface becomes covered with minute cracks. These cracks normally follow the tool marks. They extend, however, from the surface of the bore to a depth approximating a maximum of 0.0015 inch. These minute cracks accumulate fouling which is difficult to remove by merely wiping. A bore might after superficial cleaning appear to be in perfect condition, but subsequently will rust from the action of fouling and moisture remaining in these cracks.

b. Firing of a ball cartridge deposits in the bore the combusive products of powder and primer, together with plating or smears of metal from the jacket of the bullet. Combustion of the powder, being nearly complete, usually leaves a fouling of an almost harmless ash. Combustion of the primer mixture, however, deposits a

(2) Powder the ammonium persulfate and ammonium carbonate together by placing them inside a clean cloth and grinding with a tool handle. Dissolve the powdered chemicals in the water and add the ammonia. Mix thoroughly until about 90 percent of the powder is dissolved and allow to stand for 1 hour before using. The solution should be kept in a strong bottle, closed tightly with a rubber stopper, and kept in a cool place.

e. Removal of cupro-nickel metal fouling.—To remove metal fouling proceed as follows: The bore should be free from primer and powder fouling and the barrel should be cold. Place a rubber stopper in the chamber so as to seal the bore at that point. Place a 2-inch section of rubber tube over the muzzle, so that about an inch of the tube extends above the muzzle. Pour the standard metal-fouling solution carefully into the bore from the muzzle end until it rises in the rubber tube, completely covering the muzzle. If any is spilled on the exterior of the barrel, wipe it off at once. The solution should be permitted to remain in the bore from 15 to 20 minutes, but never longer than 30 minutes under any circumstances. It should never be used in a hot barrel. Pour the solution out of the bore and remove the stopper from the chamber and the rubber tube from the muzzle. Allow any remaining solution to drain out of the muzzle and at once pump water through the bore to remove all traces of it. Dry the bore and apply oil or grease as prescribed for regular cleaning. The ammonia solution dissolves the metal fouling. When tracer ammunition has been used, it may be necessary to apply the solution three or four times to remove the large amount of metal fouling deposited. It may be necessary at times to use a wire brush in conjunction with this work. Bores should be washed out with water after each cleaning.

10. Burlap, jute.—Used over the bore sponge for cleaning the bores of cannon. It is also used for covering the breech and muzzle of cannon in storage or during stand-by condition. A cotton cloth (Osnaburg) will be used in place of burlap, jute, if the latter is not available.

11. Carbon tetrachloride.—*a. Characteristics.*—(1) Heavy colorless liquid.

- (2) Volatile and incombustible.
- (3) Odor similar to that of chloroform.
- (4) Vapor is heavier than air.
- (5) Harmful to eyes.

b. Container.—Quart. bottle.

c. Method of handling.—(1) Do not keep exposed to air when not in use.

(2) If carbon tetrachloride is taken into the body by breathing its vapor, or into the digestive system through the mouth, it is quite poisonous. The symptoms of poisoning are headache, nausea, anaesthesia, followed by inflammation of the liver and kidneys, and in some cases it might lead to unconsciousness and death.

(3) In contact with the skin, this chemical may cause mild dermatitis.

(4) If carbon tetrachloride is accidentally gotten into the eyes, it causes considerable pain and produces a violent flow of tears. This effect is temporary, however. The eyes should be washed immediately with large amounts of water.

(5) Proper precautions should be taken to avoid undue exposure to carbon tetrachloride. When used openly, as in a shop, good ventilation must be provided and respiratory equipment furnished to men who work with it for a prolonged period of time.

d. Use.—(1) As a solvent for cleaning couplings and spark plug joints in tanks and combat cars. Pyrene may be used instead, if available.

(2) Used as a constituent of the liquid fill for certain types of fire extinguishers and in machine shops as a degreasing material. For ordnance purposes, however, solvent, dry-cleaning, will be used as a degreasing agent rather than carbon tetrachloride.

12. Cleaner, rifle bore.—*a. Description.*—A combination solvent and preservative which is issued for use by troops in the field for cleaning small bore arms. When cleaner, rifle bore, is not available, the bore should be cleaned with hot soap solution, soda ash solution, hot water alone, or in the absence of these, cold water. After the cleaning operation, the bore should be rinsed thoroughly with clean water, dried, and oiled. When cupro-nickel bullets are used, the bore must be cleaned with a metal swabbing solution.

b. Use.—Saturate a clean patch with cleaner, rifle bore, and push back and forth through the bore of the rifle or small arm with a cleaning rod. Repeat the operation with clean patches two or three times and then use a clean dry patch to remove all the cleaner before applying the prescribed coating of protective oil.

13. Cloths.—*a. Crocus.*—(1) *Description.*—(a) Fine, soft, red, or reddish-brown powder (tripoli or oxide of iron) on cloth sheets, 9 by 11 inches.

(b) Keeps indefinitely if stored in a fairly dry place.

gallon to have the equivalent of the 50-50 solution listed above, which is good for -40° F.

32. Solvent, dry-cleaning.—*a. Characteristics.*—(1) Colorless and inflammable liquid distilled from petroleum.

(2) Evaporates without leaving a corrosion-inducing film on machines and polished metal surfaces.

(3) Explosive and inflammable characteristics are similar to that of kerosene.

b. Container.—Gallon can.

c. Method of handling.—(1) Care is required in handling and storing solvent, dry-cleaning, because of the fire hazard. In no case should it be poured or allowed to stand in open containers around or near an open fire.

(2) Smoking is prohibited in the vicinity of or while handling the solvent.

(3) Though not quite as dangerous from the standpoint of fire hazard, the same precautions in storage and handling should be followed as those outlined in AR 850-20 for handling gasoline.

(4) Its continual use without gloves dries the skin and produces cracks. In some cases a mild dermatitis may result from its prolonged contact with the skin.

(5) Solvent, dry-cleaning, shall be handled and used in well-ventilated places.

d. Use.—(1) Used principally as a grease-removing liquid.

(2) Solvent, dry-cleaning, is used for cleaning all metal surfaces of material preparatory to application of rust-preventive compound. It is generally applied with rags to large parts and as a bath for small parts.

(3) It is used with a wire brush to loosen newly formed rust when cleaning bores of rifles.

(4) Removal of excess solvent from the material being cleaned is generally done by wiping with light-colored cloth until no staining of the cloth occurs.

(5) To avoid leaving finger marks, which are ordinarily acid and induce corrosion, gloves should be worn by persons handling parts after such cleaning.

(6) Solvent, dry-cleaning, like most petroleum products, will attack and discolor rubber. It is noncorrosive to metal, but for the most careful work and protection of highly machined surfaces against corrosion, it will be necessary to apply corrosion-preventive compound or lacquer, as the case may be, immediately after cleaning the material with solvent.

(7) Solvent may contain traces of water, in which case corrosion will be accelerated. For this reason corrosion-preventive measures must be taken immediately after its use.

(8) Gasoline should not be used for the above-mentioned cleaning purposes. The increased fire hazard occasioned by its use, together with the toxic nature and corrosion-accelerating properties of gasoline-containing leaded compounds, make its use undesirable.

33. Decontamination.—*a. Protective measures against contamination.*—(1) For matériel in constant danger of gas attacks, whether from chemical clouds, chemical shells, or chemical spray, care should be taken to keep all unpainted metal parts of the engines, instruments, guns, mountings, and accessories well-coated with oil.

(2) Ordinary fabrics of wool or cotton offer practically no protection against vesicants (lewisite, mustard gas, and ethyldichloroarsine). Rubber and oilcloth will be penetrated by vesicants within a short time. The longer the period during which they are exposed, the greater the danger in wearing these articles. Rubber boots worn in an area shelled heavily with lewisite or mustard gas may be a grave danger to men who wear them several days after the bombardment. Impervious cloth, such as is used in the manufacture of impermeable clothing, will resist penetration by liquid vesicants for over an hour, but soon after this time the clothing becomes dangerous. Fabrics which are lightly contaminated may be decontaminated, but if the articles are heavily covered with mustard, they should be destroyed by burying or burning in areas where the fumes from the fire will not affect personnel or animals.

(3) Metal parts of all instruments should be covered with oil and protected with covers when not in actual use, care being taken that the oil does not come in contact with any glass or find its way into the interior of the instruments.

(4) Ammunition should be kept in sealed containers. If exposed to gases, corrosion is likely to occur, particularly on brass parts.

b. Cleaning.—(1) All unpainted metal parts of the vehicle and engine, together with all accessories and spare parts exposed to any gas except mustard or lewisite, must be cleaned with solvent, dry-cleaning, or alcohol, denatured, and wiped dry as soon as possible after the attack, and in any case within 24 hours, after which they should again be thoroughly coated with oil.

(2) Exposed ammunition should be cleaned with agent, decontaminating, noncorrosive, or, if this is not available, with strong soap and cool water. Corroded ammunition should either be cleaned thoroughly or discarded. Ammunition containers should be cleaned

in the same manner. *Do not use dry, powdered agent, decontaminating (chloride of lime), on or near ammunition supplies* as flaming occurs through the use of the chloride of lime on liquid mustard thereby causing high concentration of mustard vapors.

c. Personal care.—(1) The following measures should be taken when removing liquid vesicants (mustard, lewisite) from various materials and equipment (guns, ammunition, web, leather equipment, wood, metals, rope, etc.), which have come in contact with these liquid chemicals.

(2) For all of the decontamination operations indicated, a complete suit of impermeable clothing and a service gas mask must be worn. Removal of protective clothing should be performed with the assistance of other persons equipped with gas masks and rubber gloves, so as to minimize the danger of getting mustard on the skin. Immediately after the removal of the suit, a thorough bath with soap and water (preferably hot) must be taken.

(3) Should any skin areas have come in contact with mustard, liquid, cleanse with solvent, dry-cleaning, any oil, alcohol, carbon tetrachloride, or pyrene prior to taking the soap and water bath. If the face has been exposed to the vapor, or if even a very small drop of mustard gets into an eye, immediate care must be given to prevent serious injury. The eyes should be flooded with water or solution of boric acid. The insides of the lids and the eyeball must both be thoroughly washed. An eye cup, syringe, or dropper will help in this process. Repeat the washing *hourly*. If vapor has been breathed, treat and handle as a lung irritant casualty (complete rest and nonalcoholic stimulants). Symptoms arising from contact with mustard appear 2 to 4 hours after exposure. Thorough cleaning, as outlined above, will minimize or completely prevent all symptoms, *if done within 20 or 30 minutes after exposure*.

(4) Do not attempt to wear the protective suit again until it has been decontaminated. If exposed to vapor only, these garments may be cleaned satisfactorily by hanging in the open air, preferably sunlight, for several days. Permeable protective clothing exposed to vapor may also be decontaminated by steaming for 2 hours. Various kinds of steaming devices can be improvised from materials available in the field. The simplest is merely a large GI can provided with a false bottom which serves to hold the clothing about a foot from the true bottom. Six or 8 inches of water is poured into the bottom of the can, the false bottom inserted, and the garments piled in. The can is then placed over a fire, the top covered but not so tightly as to prevent the escape of steam. Steam the clothes for at least 2 hours

after steam first appears from around the lid. If the clothing has been splashed with liquid mustard, steaming for 6 to 8 hours will be required. Add water to the GI can from time to time to prevent all the water boiling out.

d. Decontamination of matériel.—(1) Commence by freeing the objects of dirt, lumps of earth, and liquid with woolen spatulas, rags, etc., which will be burned or buried immediately after this operation. Care must be taken to protect personnel against vapors arising from burning rags.

(2) Vesicant-contaminated metal surfaces that are greased or oiled must first be cleaned with solvent, dry-cleaning, or other available solvents for oil, and swabbed with rags attached to the ends of sticks. Burn all used rags and sticks. Such cleaning removes most of the mustard gas, but a thin film remains, which must be neutralized. This is done with a bleaching solution made by mixing 1 part agent, decontaminating (chloride of lime), with 1 part water, which should be swabbed over all surfaces. To prevent serious corrosion, do not allow bleaching solution to remain in contact with metal surfaces longer than 1 hour. Remove the bleaching solution by washing with water. After drying, polish and oil all surfaces. The use of agent, decontaminating (chloride of lime), in the dry powder form is not recommended, as it reacts violently with liquid mustard gas, causing flaming and the formation of a high concentration of mustard gas vapor.

(3) Exposed surfaces of all instruments and unpainted metal working parts (such as breechblocks, traversing screws, etc.) exposed to mustard gas or lewisite must be cleaned with one of the following:

(a) Warm water and soap.

(b) Alcohol, denatured.

(c) Solvent, dry-cleaning.

(d) Agent, decontaminating, noncorrosive, mixed 1 part solid to 15 parts solvent (acetylene tetrachloride) by weight.

(4) Remove all traces of agent or solvent by wiping with clean, dry rags. Bleaching solution must not be used because of its corrosive action.

(5) Clean instrument lenses as per directions given in paragraph 20. All leather and canvas parts should be thoroughly scrubbed with bleaching solution, or discarded. At the earliest opportunity, coat all metal surfaces with light machine oil. In the event mustard has penetrated into joints of the instrument, the instrument should be replaced at the earliest opportunity and returned to ordnance personnel for disassembly and thorough cleaning.

(6) Gun bores should be swabbed out with strong soap and water, dried thoroughly, then oiled with oil, engine, SAE 10.

(7) In the event that agent, decontaminating (chloride of lime), is not available, large volumes of hot water and soap may be used to decontaminate matériel. Scrubbing with hot water will wash mustard onto the ground, where it will lie at the bottom of pools and puddles. Therefore, all equipment should be removed from the contaminated area before protective clothing, and particularly the service gas mask, is removed. Such areas should be plainly marked with warning signs before abandonment. After washing equipment in the above manner, it will be necessary to protect all personnel continually against the danger of slow vaporization of mustard from areas not reached by the scrubbing, or from leather, canvas web, etc., particularly during the heat of the day. Thorough decontamination with bleaching solution should be performed at the first opportunity on all parts not accessible by scrubbing and on all porous materials.

(8) Scrubbing metal surfaces with cold water will remove and partially decompose lewisite to an extremely toxic toxoid. Prolonged contact with water tends to reduce its vesicant properties to a considerable extent. As the ultimate decomposition product of lewisite is a vesicant, arsenic compound, whether chloride of lime or water is used in decontaminating, water supplies which drain from a lewisite-contaminated area are poisoned and are unfit for consumption by men or animals. Rain falling on equipment formerly contaminated with lewisite and cleaned in the field will wash sufficient arsenic into the puddles to make them dangerous for consumption by horses.

e. Transportation of matériel contaminated by chemicals.—The removal will be effected by automotive units whenever possible. If horse transport must be used, the route will be carefully reconnoitered in order to avoid contaminated ground. The matériel will be decontaminated as thoroughly as possible before its removal.

f. Special precautions for automotive matériel.—(1) When vehicles have been subjected to clouds of gas with the engine running, it will be necessary to service the air cleaner by removing old oil, flushing with solvent, dry-cleaning, and refilling with engine oil of the proper grade.

(2) Instrument panels should be cleansed as outlined in *d*(3) above. Seat cushions that have been sprayed with mustard should be discarded. Washing the compartments thoroughly with bleaching solution is the most that can be done in the field. Driving personnel should be on the alert constantly for slow vaporization of

mustard gas, particularly when the equipment gets warm. Contaminated harness should be cleaned carefully before use.

(3) Exterior surfaces of vehicles should be decontaminated with bleaching solution. Repainting may be necessary after this operation.

g. For additional information with respect to decontamination see FM 21-40 and TM 3-215 and 3-220.

SECTION III

PRESERVATIVES

	Paragraph
Rust.....	34
Corrosion.....	35
Inspection for corrosion.....	36
Preparation of metal surfaces for slushing.....	37
Rust preventives.....	38
Compounds.....	39
Method of applying rust-preventive compounds.....	40
Slushing of small arms.....	41
Inspection of corrosion-preventive film.....	42
Storage conditions.....	43
Method of slushing recoil, counterrecoil, and buffer mechanisms.....	44
Corrosion-preventive measures for guns in service.....	45
Lead, white, basic carbonate, paste, and lead, white, basic sulfate.....	46
Naphthalene, flake.....	47

34. Rust.—*a. General.*—Rust is a compound formed by the oxidation of iron in the presence of water. There are two kinds, ordinarily known as red rust and black rust. Black rust does not progress under ordinary conditions. Red rust progresses as an infection, thus it is obvious that all red rust must be completely removed from the surface of iron or steel to assure stoppage of rusting. It can be removed by mechanical rubbing or polishing, by sandblasting, or by chemical means. The application of paint or of corrosion-preventive compound will greatly retard the progress of rusting. However, the propagation of rust can take place beneath these coatings. If rust has been removed by chemical means, it is most essential that the chemical be neutralized and completely removed after the work of rust removal is finished. The article should then be thoroughly dried before the rust-preventive compound or paint is applied. Sandblasting can be used only where there is no possibility of the abrasive getting into moving parts during or after the blasting operation. Bearings, bearing surfaces, or finely machined parts must never be sandblasted.

b. Rust pits.—In its earliest stages rust or corrosion may appear as an almost invisible discoloration. This discoloration gradually darkens in color to a yellowish or reddish tinge and progresses until

ORDNANCE DEPARTMENT

APPENDIX

LIST OF REFERENCES

1. **Standard Nomenclature Lists.**—*a. Cleaning and preserving.*
 Cleaning, preserving, and lubricating materials..... SNL K-1.
 Soldering, brazing, and welding material..... SNL K-2.
- b. OPSI.*—Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"..... OPSI.
2. **Explanatory publications.**—*a. Lubrication.*
 Automotive lubrication..... TM 10-540.
 Lubrication instructions..... OFSB, 6-series.
 War Department Lubrication Guides.
- b. Chemical attack.*
 Decontamination..... TC 88, 1941.
 Defense against chemical attack..... FM 21-40.
 Military chemistry and chemical agents..... TM 3-215.
- c. Maintenance.*
 Maintenance of matériel..... OFSB, 4-series.
 Motor transport..... FM 25-10
 Motor transport inspections..... TM 10-545.
 Ordnance maintenance procedure—matériel inspection and repair..... TM 9-1100.
 Precautions in handling gasoline..... AR 850-20.
 Preservation and care of seacoast defense matériel..... TM 4-245.
 Storage of motor vehicle equipment..... AR 850-18.
- d. Welding.*
 Electric and oxyacetylene welding..... OFSB 5-2.
 The blacksmith and the welder..... TM 10-440.
 Welding..... TM 1-430.

INDEX

INDEX

	Paragraph	Page
Abrasives.....	13, 14	9, 12
Acetone, grade B.....	65	47
Acid, muriatic.....	84	67
Acetylene.....	91	68
Acetylene cylinders.....	98	74
Alcohol, denatured.....	82	66
Aluminum paint.....	64	47
Ammonia, 28 percent.....	6	5
Ammonium—		
Carbonate.....	7	6
Chloride.....	89	68
Persulfate.....	8	6
Antiseize compound.....	118	98
Artillery, lubrication.....	76	55
Benzine, grade C.....	66	47
Bores, cleaning.....	4, 5	3, 5
Brushes.....	68, 116	49, 98
Buffer mechanisms.....	44	36
Burlap, jute.....	10	8
Calcium carbide.....	90	68
Carbon dioxide.....	103	77
Carbon tetrachloride.....	11	8
Chalk.....	117	98
Cleaner, rifle bore.....	12	9
Cleaning.....	4-33	2
Cloth, cotton.....	10	8
Cloths.....	13	9
Compounds:		
Antiseize.....	118	98
Cleaning.....	16	13
Preserving.....	30, 40	31, 32
Welding.....	83	67
Compressed—		
Air.....	92	69
Hydrogen.....	93	69
Oxygen.....	95	70
Containers, lubricants.....	69	50
Corrosion.....	35, 86	28, 29
Corrosion-preventive—		
Film, inspection.....	42	34
Measures for guns in service.....	45	36
Cotton cloth.....	10	8
Counterrecoil mechanisms.....	44	36
Crocus cloth.....	13	9
Cupro-nickel metal fouling.....	9	7

INDEX

	Paragraph	Page
Cyanide of potassium.....	127	100
Cylinders:		
Acetylene.....	98	74
Gas.....	96	70
Oxygen.....	97	72
Decontamination.....	33	23
Dressing:		
Belt.....	110	99
Russet leather.....	27	18
Drier, liquid paint.....	56	44
Dry-cleaning solvent.....	32	22
Emery cloth.....	13	9
Enamel, synthetic, olive-drab, lusterless.....	53	43
Ethylene glycol.....	120	99
Fire-control instruments, lubrication.....	77	56
Fire extinguisher:		
After charging.....	112	93
Carbon dioxide, characteristics.....	103	77
Description.....	102	76
Operation.....	104	70
Precautions.....	105	81
Recharging:		
Disk type cylinders.....	110	90
Parts and equipment.....	115	96
Procedure.....	108	83
Pump.....	111, 114	91, 95
Sent type cylinders.....	109	85
Shipment.....	107	82
Storage.....	106	82
Test for leaks.....	113	94
Types.....	101	76
Flannel.....	21	17
Flask, Florence.....	121	100
Flint paper.....	14	12
Fluids for recoil mechanisms and hydraulic jacks.....	78-82	57
Flux, zinc chloride.....	85	67
Fluxes.....	83	67
Fouling, metal.....	5	5
Gas cylinders.....	96	70
Gas, decontamination.....	33	23
Glass, optical.....	20	16
Glycerin, grade A, U. S. P.....	79	57
Glycerin-water recoil fluids.....	80	58
Graphite.....	70	50
Grease:		
Graphite, soft.....	71	51
Special, low temperature.....	74	54
Guns in service, corrosion prevention.....	45	30

INDEX

	Paragraph	Page
Helmets, painting.....	55	44
Hydraulic jacks, fluid.....	78-82	57
Inspection, corrosion-preventive film.....	42	34
Inspection for corrosion.....	36	29
Jute—		
Burlap.....	10	8
Twine.....	130	101
Knife, putty.....	122	100
Lacquer.....	57	44
Lead:		
Red, dry.....	52	42
White.....	46	36
Leather.....	26-28	18
Lens, tissue paper.....	19	16
Lime, hydrated.....	17	14
Linseed oil, raw.....	59	45
Litmus paper.....	126	100
Lubricants.....	69-77	49
Lye.....	18	14
Machine guns, lubrication.....	75	54
Metal—		
Fouling.....	5	5
Fouling solution.....	9	7
Polish.....	22	17
Surface, preparation for slushing.....	37	30
Mixture, liquid, for red lead paint.....	58	45
Moths.....	47	37
Muriatic acid.....	84	67
Naphthalene, flake.....	47	37
Neat's-foot oil.....	26	18
Needle, sacking.....	123	100
Nitrogen, 99.5 percent.....	94	69
Oil:		
Lubricating.....	72	51
Neat's-foot.....	26	18
Quenching.....	100	75
Recoil.....	81	59
Optical glass, care.....	20	16
Oxygen:		
Compressed.....	95	70
Cylinders.....	97	72
Paint:		
Aluminum.....	63, 64	46, 47
Blue marking.....	125	100
Brushes.....	68	49
Driers.....	56	44

Paint—Continued.	Paragraph	Page
Handling.....	40	39
Hazards.....	51	41
Helmets.....	55	44
Lacquers.....	57	44
Mixture, liquid, for red lead.....	58	45
Olive-drab enamel.....	53	43
Preparation of surface.....	50	39
Primers.....	54	43
Red lead.....	52	42
Remover.....	67	48
Selection.....	48	38
Palm, salthmaker's.....	124	100
Paper:		
Flint.....	14	12
Lens tissue.....	19	16
Litmus.....	126	100
Paraffin.....	25	18
Paste:		
Metal polish.....	22	17
Soldering.....	86	68
Patches, cut.....	21	17
Petroleum.....	73	54
Polish, metal, paste.....	22	17
Potassium, cyanide.....	127	100
Preservatives.....	34-47	27
Primers.....	54	43
Publications.....	App.	102
Putty.....	60	45
Putty knife.....	122	100
Quenching oil.....	100	75
Recoil mechanism.....	44, 78-82	36, 57
Recoil oils.....	81	59
Red lead paint.....	52, 58	42, 45
References.....	99, App.	75, 102
Remover, paint and varnish.....	67	48
Rifle bore, cleaner.....	12	9
Rosin.....	87	68
Rust.....	34	27
Rust preventives.....	38	31
Sacking needle.....	123	100
Safety measures, lubricants.....	60	50
Salthmaker's palm.....	124	100
Sal ammoniac.....	89	68
Salt, soldering.....	88	68
Slushing:		
Preparation.....	37	30
Recoil, counterrecoil, and buffer mechanisms.....	44	36
Small arms.....	41	33

Small arms:	Paragraph	Page
Cleaning.....	4	8
Lubricating.....	75	54
Preserving.....	41, 45	33, 36
SNL's.....	App.	102
Soap:		
Castle.....	23	17
Saddle.....	24	18
Sponging solution.....	31	20
Soda ash.....	29	20
Soda, caustic.....	18	14
Sodium hydroxide pellets.....	78	57
Soldering—		
Paste.....	86	68
Salt.....	88	68
Solution:		
Metal-fouling.....	9	7
Sponging.....	31	20
Solvent, dry-cleaning.....	32	22
Sponges.....	30	20
Sponging solution.....	31	20
Stopper, rubber.....	128	101
Storage conditions.....	43	35
Target matériel.....	55	39
Tubing, rubber, 2-inch section.....	129	101
Turpentine.....	61	46
Twine, jute.....	130	101
Varnish, mixing.....	63	46
Varnishes.....	62	46
Wastes.....	15	12
Welding.....	83-100	68
White lead.....	46	36
Whiting.....	60	45
Wiping, cotton.....	13	9
Zinc chloride flux.....	85	67

[A. G. 062.11 (7-30-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

D (2); D and H 17 (6); R and H 2, 6, 17 (2); R 10, 5 (5); Bn 2,
3, 6, 10, 11, 17 (3); Bn and H 4, 5, 7 (5); C 2, 3, 4, 10, 11 (5);
C5, 6, (10); C7, 17 (15).

(For explanation of symbols see FM 21-6.)